Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A haptic interface device to provide haptic interaction to a user manipulating a tool, the haptic interface device comprising:

an attachment point;

a first cable having a first and a second end, the first end coupled to the attachment point;

a first tool translation effecter device having coupled thereto the second end of the first cable such that, as the attachment point moves, the first cable is retracted or paid out accordingly by the first tool translation effecter device, the first tool translation effecter device including controlling means for selectively varying a tension on the first cable;

metering means for metering the first cable as it is retracted and paid out;

a brake configured to lock the first tool translation effecter device when electric current is removed therefrom; and

establishing means for establishing, during an initialization procedure, a distance between the first tool translation effecter device and the attachment point.

2. (Original) The haptic interface device of claim 1 wherein:

the controlling means includes a spool and a motor coupled to rotatably drive the spool, the motor and spool selectively operable to wind and unwind the second end of the first cable; and

the metering means includes:

counting means for counting fractions of rotations of the spool; and

compensating means for compensating for a change in ratio between changes in distance from the first tool translation effecter device to the attachment point and angular rotation of the spool.

3. (Previously Presented) The haptic interface device of claim 1 wherein the establishing means includes a controller configured to direct the first tool translation effecter device to retract, during an initialization procedure, the first cable until the attachment point is at a selected position relative to the first tool translation effecter device.

4. (Previously Presented) The haptic interface device of claim 1 wherein the establishing means includes a memory configured to receive, after current is removed from the brake and prior to a complete shutdown of the device, a known distance, and to provide the known distance during a startup procedure.

5. (Original) The haptic interface device of claim 1 wherein the establishing means includes at least one sensor configured to determining a position of the attachment point relative to the first tool translation effecter device.

6. (Original) The haptic interface device of claim 5 wherein the establishing means includes means for reestablishing the distance from time to time during operation.

7. (Previously Presented) The haptic interface device of claim 1, further comprising:

second, third, and fourth cables coupled at respective first ends to the attachment point;

second, third, and fourth tool translation effecter devices positioned, relative to each other and to the first tool translation effecter device, such that each of the first, second, third, and fourth tool translation effecter devices occupies a vertex of a tetrahedron; and

a sensor array at the attachment point configured to provide signals corresponding to an orientation of the attachment point.

8. (Original) The haptic interface device of claim 7 wherein the sensor array is configured to provide signals corresponding to roll, pitch, and yaw of the attachment point.

9. (Currently Amended) A haptic interface device to provide haptic interaction to a user manipulating a tool, the haptic interface device comprising:

an attachment point configured to receive the tool;

a plurality of not more than four cables, each cable coupled at a respective first end to the attachment point;

a plurality of tool translation effecter devices, each having coupled thereto a second end of a respective one of the plurality of cables such that, as the attachment point moves relative to that tool translation effecter device, the cable coupled thereto is retracted or paid out accordingly, each tool translation effecter device configured to selectively vary a tension on the cable coupled thereto and to meter the cable as it is retracted and paid out ; and

a sensor array associated with the attachment point and configured to provide signals corresponding to ~~an orientation~~at least one of roll, pitch, and yaw of the tool.

10. (Original) The haptic interface device of claim 1, further comprising:

second and third cables coupled at respective first ends to the attachment point; and

second and third tool translation effecter devices positioned in a triangular configuration relative to each other and to the first tool translation effecter device.

11. (Canceled)

12. (Currently Amended) A haptic device for operation by a user, comprising:

a user interface tool configured to be manipulated by the user and moved within a volume of space, and including a sensor array configured to detect ~~rotation~~ at least one of roll, pitch, and yaw of the user interface tool ~~around an axis~~;

a first, a second, a third, and a fourth tool translation effecter device, each coupled to a support structure in positions such that the first, second, third, and fourth tool translation effecter devices define between them a tetrahedron within the volume of space, each of the tool translation effecter devices including a respective spool and a respective encoder configured to provide a signal corresponding to rotation of the respective spool; and

a first, a second, a third, and a fourth cable each having a respective first and a respective second end, the first end of each of the first, second, third, and fourth cables coupled to the user interface tool and the second end of each of the first, second, third, and fourth cables wound and unwound on the spool of a respective one of the tool translation effecter devices.

13. (Currently Amended) The haptic device of claim 12 wherein the sensor array is configured to detect ~~rotation in each of three mutually perpendicular axes~~roll, pitch, and yaw of the user interface tool.

14. (Previously Presented) The haptic device of claim 12, further comprising a processor system coupled to receive the signals from the respective encoders, the processor system configured to determine movement of the tool therefrom.

15. (Original) The haptic device of claim 14 wherein the processor system is configured to compensate for changes in effective diameter of the spools of the first, second,

third, and fourth tool translation effecter devices due to changing thickness of cable on each of the spools as the respective cable is wound and unwound from the respective spool.

16. (Previously Presented) The haptic device of claim 12 wherein each of the first, second, third, and fourth tool translation effecter devices further comprises:

a motor coupled to the respective spool, each of the motors operable to selectively apply tension to the respective cable.

17. (Original) The haptic device of claim 16 wherein the processor system is configured to establish an initial position of the tool by retracting, in turn, each of the first, the second, the third, and the fourth cables to a known length position.

18. (Previously Presented) A haptic device for operation by a user, comprising:

a support structure;

a port coupled to the support structure;

a user interface tool configured to be manipulated by the user and moved within a volume of space, the user interface tool includes a tool shaft having a first and a second end, the tool shaft passing through the port such that the tool shaft pivots at the port and manipulation of the second end of the tool shaft is reflected in movement of the first end of the tool shaft;

a first, a second, a third, and a fourth tool translation effecter device, each coupled to the support structure in positions such that the first, second, third, and fourth tool translation effecter devices define between them a tetrahedron within the volume of space, each of the tool translation effecter devices including a respective spool and a respective encoder configured to provide a signal corresponding to rotation of the respective spool; and

a first, a second, a third, and a fourth cable each having a respective first and a respective second end, the first end of each of the first, the second, the third, and the fourth

cables coupled to the first end of the tool shaft and the second end of each of the first, the second, the third, and the fourth cables wound and unwound on the spool of a respective one of the tool translation effecter devices.

19. (Previously Presented) The haptic device of claim 18, further comprising:

a first sensor located at the port and coupled to the tool shaft, and configured to detect rotation of the user interface tool around an axis.

20. (Previously Presented) The haptic device of claim 18, further comprising:

a first sensor configured to detect rotation of the user interface tool around an axis, and a second sensor coupled to the second end of the tool shaft and configured to detect gripping force exerted by the user.

21. (Original) The haptic device of claim 18 wherein the second end of the tool shaft is configured to provide for the user a simulation of a selected tool.

22. (Original) The haptic device of claim 21 wherein the selected tool is formed as one of a stylus, a pen, a pliers, a wrench, a forceps, a scalpel, an endoscope, or an arthroscope.

23. (Original) The haptic device of claim 18, further comprising:

a feedback device coupled to the tool shaft and configured to selectively apply rotational force to the tool shaft.

24. (Original) The haptic device of claim 23 wherein the feedback device is located at the port.

25. (Original) The haptic device of claim 18, further comprising:

a feedback device coupled to the second end of the tool shaft and configured to selectively resist gripping force exerted by the user.

26. (Original) The haptic device of claim 14 wherein the processor system is configured to maintain a virtual environment within which the user interface tool is operated, and to provide feedback from the virtual environment to the user interface tool.

27. (Original) The haptic device of claim 14, further comprising:

a remote tool, and wherein the processor system is configured to control operation of the remote tool in accordance with the movement and orientation of the user interface tool.

28. (Original) The haptic device of claim 27 wherein the processor system is configured to provide feedback from the remote tool to the user interface tool.

29. (Previously Presented) A method, comprising:

applying a selectively variable tension to each of a plurality of cables having respective first and second ends, each of the plurality of cables coupled at its respective first end to a tool, and at its respective second end to a respective anchor point;

measuring a change of cable length between the tool and each respective anchor point; and

establishing an initial length of cable between the tool and each of the anchor points, including locking, during a shutdown procedure, each of the plurality of cables at the respective anchor point, storing a value indicative of a known length of each of the cables in a memory, and recovering the value indicative of the known length of each of the cables from the memory during a startup procedure.

30. (Original) The method of claim 29 wherein establishing an initial length of cable comprises moving the tool in turn to each of the anchor points such that the length of cable between the tool and the respective anchor point is effectively zero.

31-32. (Canceled)

33. (Original) The method of claim 29 wherein establishing an initial length of cable comprises:

tracking a position of the tool; and

correlating the position of the tool with known positions of the anchor points.

34-37 (Canceled)

38. (Currently Amended) A method, comprising:

applying tension to each of four cables, each cable having a first end coupled to a tool and having a second end coupled to a respective vertex of a tetrahedron such that, as the tool is moved closer to any of the vertices the respective cables are drawn in at the respective vertices, and as the tool is moved away from any of the vertices the respective cables are fed out from the respective vertices;

measuring a length of cable drawn in or fed out at each of the vertices;

deriving a change of position of the tool on the basis of the measured length to each of the vertices of the tetrahedron; and

measuring ~~rotation~~ at least one of roll, pitch, and yaw of the tool ~~about an axis~~ by receiving a signal from a sensor operatively coupled to the tool.

39. (Original) The method of claim 38 wherein the measuring rotation step comprises measuring rotation of the tool about three mutually perpendicular axes.

40-41. (Canceled)

42. (Previously Presented) The haptic device of claim 13, further comprising a processor system coupled to receive information from the sensor array and coupled to receive the signals from the respective encoders, the processor system configured to determine movement and orientation of the tool therefrom.

43-48. (Canceled)

49. (Previously Presented) The haptic interface device of claim 9 wherein each of the plurality of tool translation effecter devices is positioned relative to each other such that each tool translation effecter devices occupies a vertex of a tetrahedron.

50. (Previously Presented) The haptic interface device of claim 9 wherein each of the plurality of tool translation effecter devices includes a brake configured to lock the respective tool translation effecter device while the haptic interface device is powered down.

51. (Previously Presented) The haptic interface device of claim 9, further comprising:

establishing means for establishing, during an initialization procedure, a distance between each of the tool translation effecter devices and the attachment point.

52. (Previously Presented) The haptic interface device of claim 9 wherein the sensor array is configured to provide signals corresponding to each of a roll, a pitch, and a yaw of the tool.

53. (Previously Presented) The haptic device of claim 12 further comprising:

a first, a second, a third, and a fourth brake coupled to respective ones of the first, the second, the third, and the fourth tool translation effecter devices and configured, when engaged, to prevent rotation of the spools associated with the respective tool translation effecter devices.

54. (Previously Presented) The haptic device of claim 12 wherein the device comprises no more than four cables.

55. (Previously Presented) The method of claim 34, comprising:

locking, during a shutdown procedure, each of the plurality of cables at the respective anchor point;

storing a value indicative of a known length of each of the cables in a memory; and

recovering the value indicative of the known length of each of the cables from the memory during a startup procedure

56. (Previously Presented) The method of claim 35 wherein applying tension comprises applying a selectively variable tension to each of the plurality of cables.